



NASA Balloon Community Workshop

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Report by NASA Headquarters View of the Program Scientist

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Mission of the Balloon Program

The Balloon Program Seeks to be a Springboard for Space Science by Providing Low-cost Access to Space at altitudes up to 160,000 ft for:

- Science Investigations that can be done above ~ 99.5% of the Atmosphere
- Observatory-class Payloads with Advanced Technologies and Large Aperture/Mass
- Technology Development and Flight Validation for Future Space Missions
- Cutting edge science in 10 - 40 day missions, with plans for 60 - 100 days flights as alternative to Shuttle or ELV launches
- Hands-on Training of Students and Young Scientists
 - Average ~ 20 missions/year
 - Involves ~ 40 University and Center groups,
 - ~ 200 Scientists and Engineers,
 - ~ 25 Graduate Students, ~ 50 Undergraduate Students,
 - Substantial Foreign Involvement at ~25% of SMD level

Science Payloads Are Solicited in Annual ROSES NRA's and Funded by SR&T/R&A Grants



Astronomy and Astrophysics Disciplines Are The Greatest Benefactors of NASA Ballooning

- Currently, about 85% of NASA flights are for Astronomy Astrophysics Disciplines
 - Cosmic Microwave Background, Infrared/Sub-mm Astronomy
 - Gamma Rays, Hard X-Rays, Cosmic Rays
 - Anti-particles/Dark Matter Search
 - High Energy Neutrinos
 - UV and Soft X-Ray Astronomy
- About 15% of NASA flights are for Non-Astronomy and Astrophysics Disciplines
 - Earth Science
 - Solar and Heliospheric Physics
 - Geospace Sciences
- Earth Science, primarily the Upper Atmospheric Research Program, consumed ~ 1/3 of all balloon flights before UARS
- Earth Science would be “welcome back,” and other users would be welcome!



U.S. Science Priorities

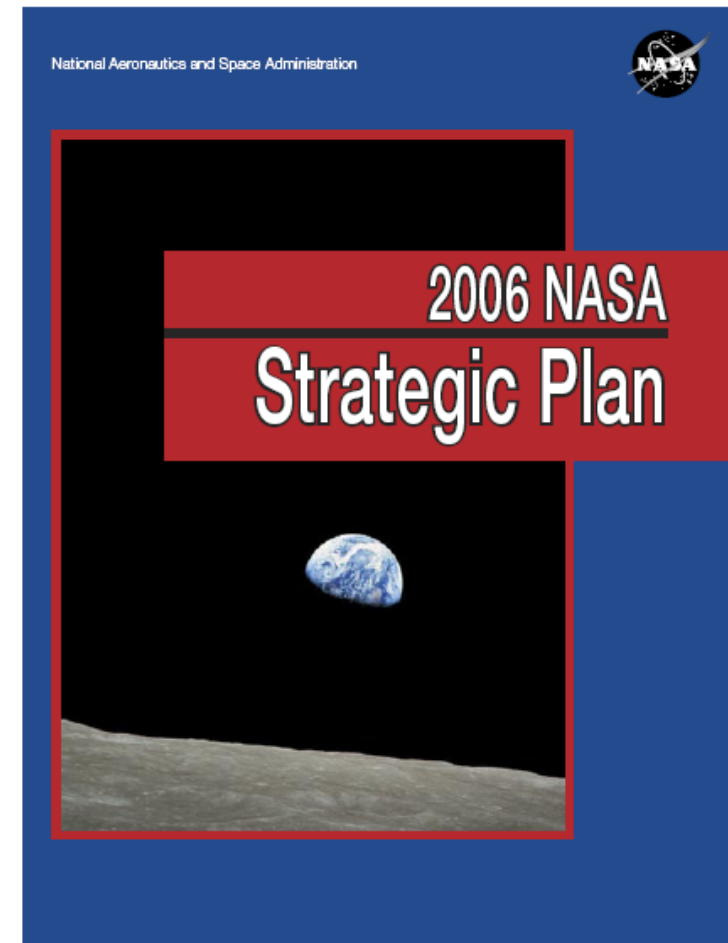
- For the past 50 years, U.S. Astronomy and Astrophysics priorities have been driven by decadal surveys ▪ with oversight by the National Academy of Sciences / National Research Council (NAS/NRC)
- The Astronomy and Astrophysics Survey Committee Co-Chaired by Joseph H. Taylor, Jr. and Christopher F. McKee conducted the most recent study “*Astronomy and Astrophysics in the New Millennium,*” National Academy Press, Washington, D.C., (2001)
- The Committee on Physics of the Universe, Chaired by Michael S. Turner, conducted a nearly parallel study on the frontiers of research at the intersection of physics and astronomy: “*Connecting Quarks with the Cosmos: Eleven Science Questions for the New Century*” National Academy Press, Washington, D.C., (2001)
- Other disciplines are beginning to use NAS/NRC Decadal Studies
 - The first Earth Science Decadal Study appeared this year



NASA Implements External Studies with Agency Strategic Plans: The 2006 NASA Strategic Goals

<http://www.nasa.gov/about/budget/index.html>

- **Goal 1:** Fly the Shuttle as safely as possible until its retirement, not later than 2010
- **Goal 2:** Complete the International space Station in a manner consistent with NASA's International Partner commitments and the needs of human exploration
- **Goal 3: Develop a balanced overall program of science, exploration, and aeronautics consistent with the redirection of the human spaceflight program to focus on exploration.**
- **Goal 4:** Bring a new Crew Exploration Vehicle into services as soon as possible after Shuttle retirement.
- **Goal 5:** Encourage the pursuit of appropriate partnerships with the emerging commercial space sector.
- **Goal 6:** Establish a lunar return program having the maximum possible utility for later missions to Mars and other destinations.

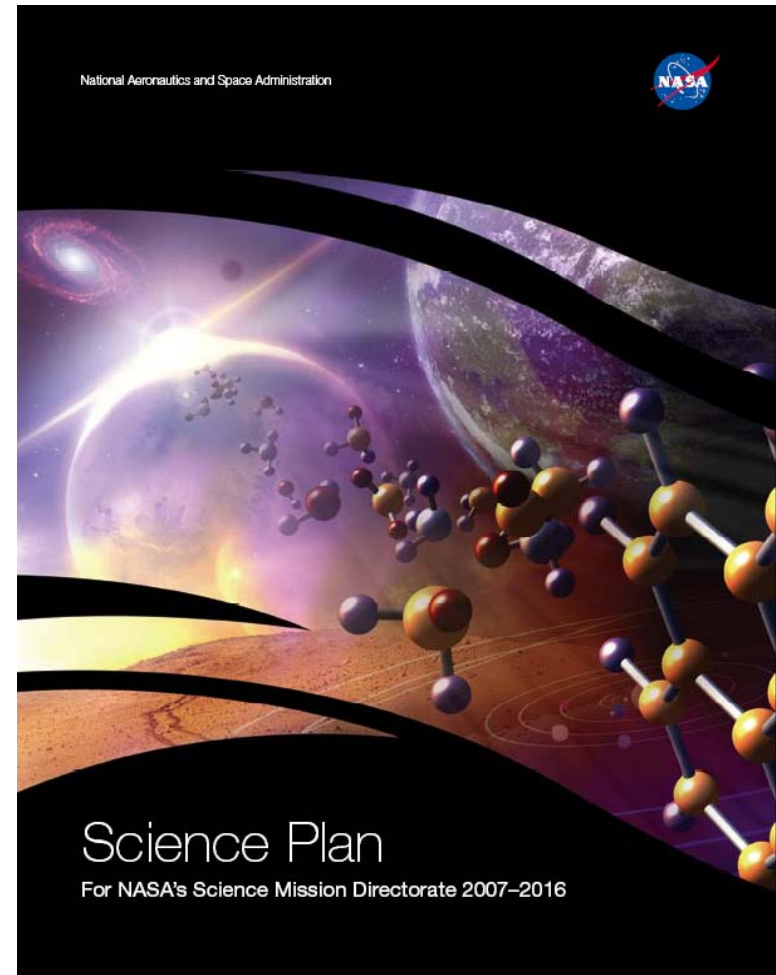




NASA's Science Plan Addresses Strategic Goal 3

http://science.hq.nasa.gov/strategy/Science_Plan_07.pdf

- Sub-goal 3A: Study Earth from space to advance scientific understanding and meet societal needs.
- Sub-goal 3B: Understand the Sun and its effects on earth and the solar system.
- Sub-goal 3C: Advance scientific knowledge of the origin and history of the solar system, the potential for life elsewhere, and the hazards and resources present as humans explore space
- Sub-goal 3D: Discover the origin, structure and destiny of the universe, and search for Earth-like planets.
- Sub-goal 3E: Advance knowledge in the fundamental disciplines of aeronautics, and develop technologies for safer aircraft and higher capacity airspace systems.

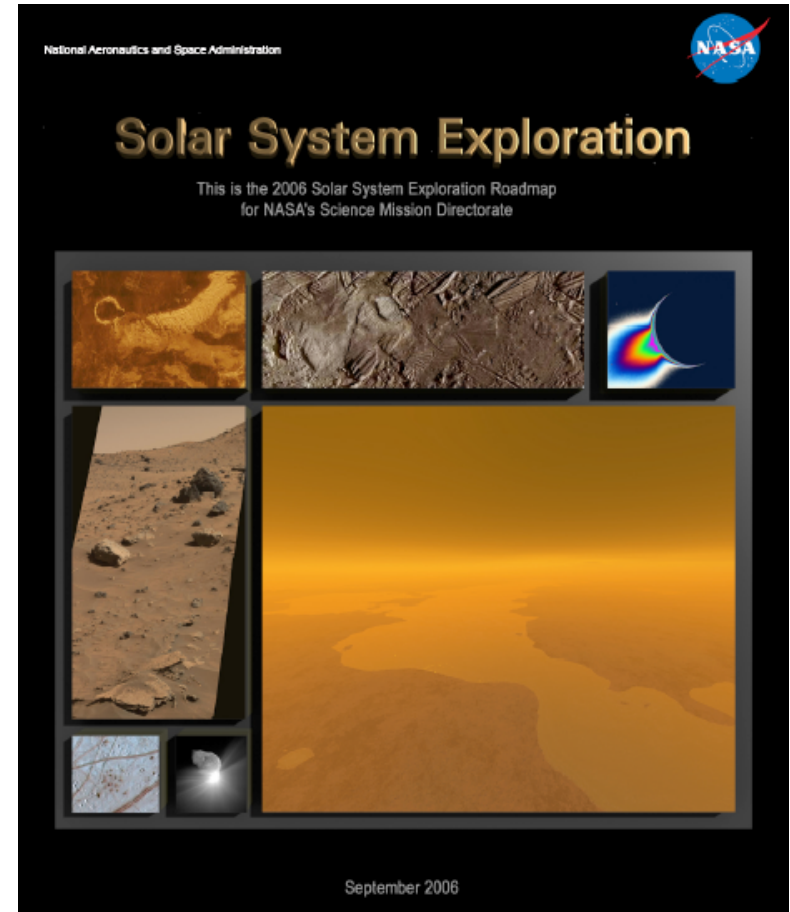




Solar System Exploration of Venus, Mars, and Titan

<http://solarsystem.nasa.gov/multimedia/downloads.cfm>

- The Roadmap for Solar System Exploration includes studies of planetary atmospheres, interiors, and surfaces
- These include comparative studies of atmospheric chemistry, dynamics, and surface-atmosphere interactions for Mars and Venus
- Balloons have the potential for collecting *in-situ* atmospheric data and high-resolution geological, geochemical, and geophysical data
- There are artist concepts for aerial platforms on Mars, Venus, and Titan

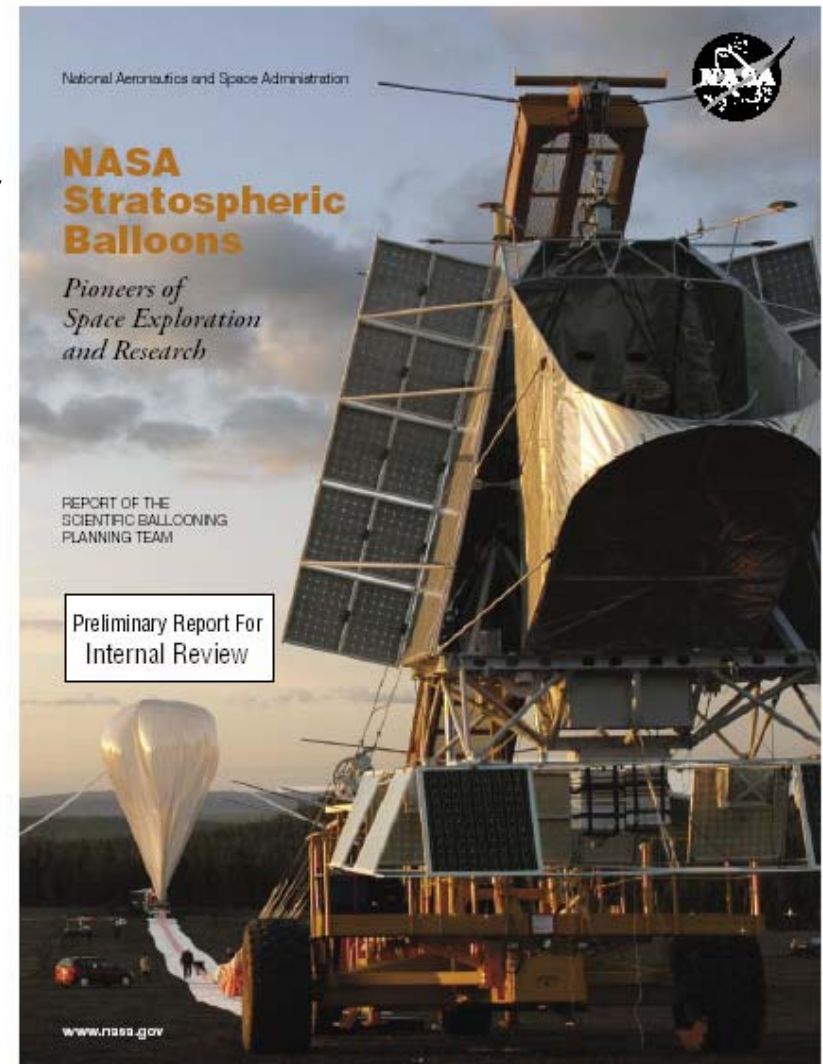




Roadmap for Balloon Support of the Science Plan

<http://www.wff.nasa.gov/balloons>

- A Preliminary Roadmap for Balloons was developed in 2005
- The Balloon Planning team, chaired by Martin Israel, Wash U., is updating the current roadmap using the guidelines given below:
 - This update will inform the next Decadal Study
- *Identify the scientific objectives for which ballooning has the greatest potential to contribute to NAS reports and NASA strategic objectives*
- *Identify the ballooning requirements for optimal and minimal programs, both in the near term and over the next 10 -15 years, and look beyond*





The President's Vision for U.S. Space Exploration “A Renewed Spirit of Discovery”

<http://www.whitehouse.gov/news/releases/2004/01/20040114-3.html>

- In support of the President’s Vision, the U.S. will:
 - Implement a sustained and affordable human and robotic program to explore the solar system and beyond
 - Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations
 - Develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration
 - Promote international and commercial participation in exploration to further U.S. scientific, security, and economic interest



National Academy Committee on Workforce Needs

http://books.nap.edu/openbook.php?record_id=11916&page=R1

- At NASA's request, a National Academy Committee has evaluated the science and technology workforce needs to meet the Vision
- This Workforce Committee concluded that NASA does not currently possess the in-house personnel with experience in the human spaceflight systems needed to implement the Vision
- But, the Committee acknowledged that NASA recognizes this fact and has taken steps to correct it, primarily by recruiting highly skilled retirees and personnel from industry
- However, the Committee questioned whether NASA is attracting and developing the talent it will need over the long term
- NASA last had substantial in-house involvement in human spaceflight systems engineering during the Space Shuttle design phase in the 1970's



“Building a Better NASA Workforce”

(Monday April 30, 2007 NAS Prepublication Copy)

Recommendation 6: Support involvement in suborbital programs and nontraditional approaches to developing skills.

- The Committee recommends that NASA increase its investment in proven programs such as sounding rocket launches, aircraft-based research, and high-altitude balloon campaigns, which provide opportunities for hands-on flight development experience.
- Rather than viewing these programs simply as low-cost, competed, scientific missions, NASA should also recognize their ability to provide valuable hands-on experience for younger workers as an equal factor in their selection, and should investigate the possibility of funding such programs through its education budget.



Low-Cost Missions to Train Scientists and Engineers

- The Science Mission Directorate (SMD) is interested in increasing the number of balloon flights in order to train future mission PI's, Project Scientists, and Systems Engineers
- SMD could add an opportunity in the annual ROSES NRA that would focus on suborbital missions to train young scientists and engineers
- Multiple scientists/institutions could be involved in a single project that does not exceed an established cost cap
- A solicitation could offer a shared gondola for independent, small-size experiments